DIGITAL BATTERY CAPACITY WARNING DEVICE.

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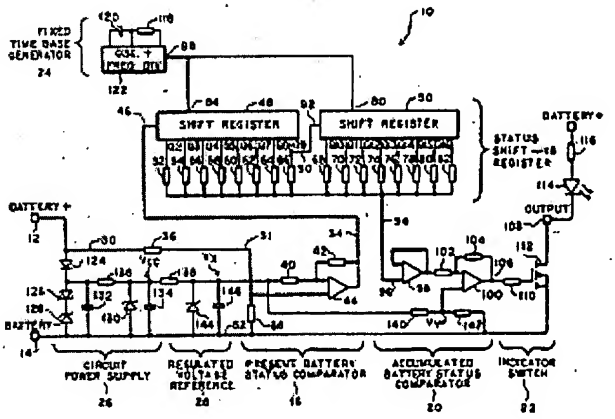
A voltage monitor and method enables the monitoring of a DC input voltage. The input voltage is continuously scanned and compared to a predetermined threshold. The result of the comparison is periodically stored in a shift register along with previous scan results. When a predetermined number of stored scan results indicate an out of range input voltage, a digital output changes state to provide indication of the abnormal condition.



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(54) DIGITAL BATTERY CAPACITY WARNING DEVICE

Digitale Batterieladungswarnvorrichtung

DISPOSITIF NUMERIQUE D'AVERTISSEMENT DE L'ETAT DE CHARGE D'UNE BATTERIE

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Description

BACKGROUND OF THE INVENTION

The present invention is generally directed to a voltage monitor for sensing a DC voltage and producing a warning that the level of the DC voltage has fallen below a predetermined level for a predetermined percentage of time. The present invention is more particularly directed to monitoring a DC voltage produced by a battery, periodically comparing the battery voltage with a threshold voltage and storing the result of the comparison. If three or more of the last sixteen comparisons indicate a low voltage, the device warns the user of the abnormal condition.

There are many applications where it may be important to sense a voltage level and provide warning of an out-of-range condition. Any DC voltage, whether generated by an AC-to-DC power supply or a depletable source such as a battery may be monitored and a warning provided if the DC voltage varies over time. One such application is a battery-powered smoke detector, where the device could activate a visual or audible warning of a low state-of-charge battery condition.

In another particular application, in the case of a battery used to start an automobile, such a warning may alert the user to an impending "no start" condition, where the battery charge is insufficient to start the automobile. Such a condition may result from a slow drop in the battery's state-of-charge. The reduced charge may be the result of an electrical problem with the car, such as a slipping belt or a failed regulator.
Alternatively, the reduced state-of-charge may be the result of battery failure, such as a broken weld or active material shedding. In such an application, a device which senses the abnormal battery voltage can alert the user to the condition so that corrective measures may be taken.

In the preferred embodiment of the present invention, the battery or power source is discharged at a particular current for large portions of time. In the smoke detector application, the battery is powering the smoke detector circuity for the majority of its time, and occasionally being tested or recharged. Similarly, in the automotive application, the battery is powering electronic hardware during non-use, resulting in a constant discharge current for the majority of the time, interrupted only occasionally by the starting and driving currents. During the constant discharge portion, a battery voltage will change to a value representative solely upon its state-of-charge.

For example, if the digital battery capacity warning device reads the voltage every 2 hours, statistically it will scan at times when the battery is at this constant discharge current and the battery voltage will be representative upon its state-of-charge. In accordance with the preferred embodiment, the warning device scan rate is selected so that two of the sixteen values are taken during the time when the battery may have been in use, as for example, 5% of the time, with the other fourteen values being taken during the time when the battery has not been in use, as for example, 95% of the time.

This device is suited to many other applications where the battery is held at rest or under a constant discharge for significant portions of time. The number of low values can be altered to reflect the percentage of time the battery is not at this constant discharge state. Similarly the frequency of the scans or number of scans can vary based upon how quickly the device is expected to respond to an out-of-limit condition.

Devices for sensing low battery voltage are generally known. U.S. Patent No. 4,902,956 issued to Sloan on February 20, 1990, describes a voltmeter and circuit breaker wired in series with selected, nonessential accessories of an automobile. The voltmeter monitors the battery voltage and interrupts the flow of current to the accessories when the battery voltage falls below a predetermined threshold. Such devices rely on a single below threshold voltage measurement by the voltmeter to cause the circuit breaker to trip and the accessories to be disconnected from the battery. Unfortunately, conditions unrelated to the battery charge, such as momentary transients in the voltage seen by the apparatus, may cause the circuit breaker to trip. Such voltage transients may be caused by inductive drops caused by suddenly changing current levels, as when an accessory is turned on or off. Alternatively, such momentary drops may occur during starting when the battery voltage may drop to as low as six volts. This sensitivity to voltage transients is an inherent and undesirable limitation on such devices. Moreover, these devices must set their threshold voltage abnormally low to prevent false indications and thereby indicate only when the battery is fully discharged. The present invention can preset the threshold voltage to indicate when the battery state-of-charge is below a predetermined value ranging from 0 to 100% with the knowledge of the battery type and constant discharge current.

DE-A-3 910 212 discloses a supply voltage monitoring circuit containing a comparator which generates a first warning signal when the voltage falls below a defined level and second signal if the voltage remains below the defined level after a predetermined period of time. A further voltage monitoring circuit generates a signal if the voltage falls below a second defined level lower then the first defined level.

DE-A-2 936 313 discloses a protection circuit for a camera that disables the camera to prevent improper operation when there is a cutout of the battery voltage. The circuit incorporates a counter that responds to a detected drop in battery voltage and produces an output signal that activates a LED alarm system.

SUMMARY OF THE INVENTION

The present invention provides a voltage monitor

and warning apparatus and method designed to satisfy the aforementioned needs.

According to the invention there is provided a voltage monitor for sensing the output voltage of a voltage source and producing an indication when said output voltage falls below a threshold voltage, said voltage monitor comprising; voltage sensing means for sensing said output voltage and including first comparator means for comparing said output voltage with said threshold voltage and generating an output when said output voltage is less than said threshold voltage; status storage means coupled to said voltage sensing means for periodically sampling and storing the status of said first comparator output so as to create an accumulated status; second comparator for comparing said accumulated status with a predetermined value; and output means for providing said indication when said accumulated status is equal to or greater than said predetermined value.

Further according to the invention there is provided a battery voltage monitor for sensing a depletable battery voltage and producing an indication when said battery voltage falls below a first threshold voltage, said battery voltage monitor comprising: threshold generating means for generating said first threshold voltage and generating an output when said battery voltage is less tan said first threshold voltage; status storage means coupled to said voltage sensing means for periodically sampling and storing the status of said first comparator output and generating an accumulated battery status; second comparator means for comparing said accumulated battery status with said second threshold voltage and generating a second comparator output when said accumulated battery status is greater than said second threshold voltage; output means responsive to said second comparator output for providing said indication; power supply means for generating a regulated supply voltage level and coupled to said first comparator means, said second comparator means, said status storage means and said threshold generating means.

According to the invention there is provided a method for sensing the output voltage of a voltage source and producing an indication when said output voltage falls below a predetermined threshold voltage, said method comprising: sensing said output voltage; comparing said output voltage with said threshold voltage and generating an output when said voltage is less than said threshold voltage; periodically sampling and storing said output and generating an accumulated status; comparing said accumulated status with a predetermined value; and producing said indication when said accumulated status is equal to or greater than said predetermined value.

According to the invention there is also provided a method for sensing a depletable battery voltage and producing an indication when said battery voltage falls below a first threshold voltage, said method comprising: sensing said battery voltage; comparing said battery voltage with said first threshold voltage and generating an output having a first state when said battery voltage is less than said first threshold voltage and a second state when said battery voltage is more than said first threshold voltage; periodically sampling and storing said output; combining said stored outputs to generate an accumulated battery status voltage; comparing said accumulated battery status voltage with a second threshold voltage; and producing said indication when said accumulated battery status voltage is greater than said second threshold voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with further objects and advantages thereof, may best be understood by making reference to the following description taken in conjunction with the accompanying drawing, in the sole figure of which identical reference characters indicate identical elements, and wherein the sole figure is a schematic diagram illustrating the manner in which the present invention may be implemented in hardware form in accordance with a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the sole figure, it illustrates a voltage monitor 10 embodying the present invention. The voltage monitor 10 as illustrated is of a type which can be used to repetitively measure a DC voltage and provide an indication when three or more of the previous sixteen measurements have been less than a predetermined threshold voltage. Such a voltage monitor is particularly adapted for monitoring a depletable battery such as is used in a motor vehicle.

The voltage monitor 10 generally includes a positive input 12 and a negative input 14, a present battery status comparator 16, a status shift register 18, an accumulated battery status comparator 20 and an indicator switch 22. The preferred embodiment of voltage monitor 10 further includes a fixed time base generator 24 to provide a clocking signal to the status shift register 18, circuit power supply 26 and regulated voltage reference 28. The voltage between positive input 12 and negative input 14 is the input voltage to be monitored. When accumulated battery status comparator 20 indicates that this input voltage has been below a predetermined threshold during three or more of sixteen measurements, the digital state of indicator switch 22 changes to provide an indication of the abnormal condition.

The present battery status comparator 16 has a first input 30 coupled to positive input 12, a second input 32 coupled to negative input 14, and an output 34. It includes resistors 36, 38, 40, 42 and operational amplifier 44. These circuit elements are configured as a voltage

comparator with hysteresis of a type well-known in the art. A voltage linearly proportional to the voltage at positive input 12 is present at input 31. The magnitude of the voltage at input 31 is continuously compared with the predetermined threshold voltage Vx. So long as this input voltage remains greater than threshold voltage Vx, the output of the present battery status comparator 16 remains low. In accordance with this preferred embodiment, the low state corresponds to the potential at negative input 14. When the voltage at input 31 falls below the threshold voltage Vx, the output of the present battery status comparator 16 changes to a high state. In the preferred embodiment, the high state corresponds to the potential at output Vcc of the circuit power supply 26. If the voltage at input 31 later changes to a level greater than threshold voltage Vx, the output of present battery status comparator 16 will return to a low state. Such a change may result if the input voltage experienced a momentary reduction in its magnitude, perhaps due to a heavy load placed on the voltage source, as during starting an automobile.

The output 34 of present battery status comparator 16 is coupled to the input 46 of status shift register 18. Status shift register 18 preferably comprises first digital shift register 48, second digital shift register 50 and resistors 52 through 82. First digital shift register 48 and second digital shift register 50 have clock inputs 84 and 86, respectively, coupled to output 88 of fixed time base generator 24. Output 90 of first digital shift register 48 is coupled to input 92 of digital shift register 50 to provide sixteen bit shift register capacity.

First digital shift register 48 and second digital shift register 50 each preferably comprise eight one-bit storage locations which are ordered sequentially from lowest to highest. Each digital shift register preferably has eight data outputs, Q2-Q9 and Q10-Q17, coupled to and corresponding to the eight one-bit storage locations, in order that the contents of each storage location may be detected. The input of each digital shift register is coupled to the lowest-ordered storage location. Each digital shift register responds to a clock signal by incrementing the contents of the digital shift register. That is, each digital shift register discards the contents of the highest-ordered storage location, moves the contents of each storage location to the next-highest-ordered storage location, and stores the digital data present at the input in the lowest-ordered storage location.

In accordance with this preferred embodiment of the present invention, fixed time base generator 24 periodically provides a clock signal to first digital shift register 48 and second digital shift register 50 at a predetermined frequency. This frequency is preferably one cycle per two hours, but may be faster or slower as required.

When first digital shift register 48 and second digital shift register 50 receive the clock signal at clock inputs 84 and 86, respectively, the contents of each digital shift register are incremented and the digital state present at input 46 is stored in the lowest-ordered storage element of first digital shift register 48. The contents of the highest-ordered storage location of first digital shift register 48 are stored in the lowest-ordered storage location of second digital shift register 50. The contents of the highest-ordered storage location of second digital shift register 50 are discarded. Together, first and second digital shift registers 48 and 50 form sixteen-bit status shift register 18.

The digital output of the present battery status comparator 16 is periodically scanned and stored. The previous sixteen scans are stored. Each scan saves the present comparator output and discards the oldest. The stored digital values are available at the outputs Q2-Q17 of digital shift registers 48 and 50.

The sixteen digital outputs Q2-Q17 of digital shift registers 48 and 50 are coupled together through resistors 52-82 to output 94 of status shift register 18. Preferably, the digital outputs Q2-Q17 have as their low value the potential at negative input 14 and as their high value the power supply voltage Vcc of the circuit power supply 26. By coupling together the sixteen digital shift register outputs Q2-Q17, output 94 of status shift register 18 may take on any of sixteen discrete values between the potential at negative input 14 and Vcc. If all of outputs Q2-Q17 have a low value, output 94 will have the same low value. If all of outputs Q2-Q17 have a high value, output 94 will have a high value. The value of output 94 will increase in a linear stepwise fashion as additional ones of the outputs Q2-Q17 take on a high value.

Output 94 of status shift register 18 is coupled to input 96 of accumulated battery status comparator 20. In the preferred embodiment, accumulated battery status comparator 20 includes operational amplifiers 98 and 100, resistors 102 and 104 and output 106. Operational amplifier 98 is configured as a voltage follower with unity gain, in a manner well-known in the art. Operational amplifier 100 is configured with resistors 102 and 104 as a voltage comparator with hysteresis, as is well-known in the art. Operational amplifier 100 compares the output of operational amplifier 98 with a threshold voltage Vy. Threshold voltage Vy is derived from and is a fraction of threshold voltage Vx. When the voltage at the output 94 of status shift register 18, as buffered by operational amplifier 98, is less than threshold voltage Vy, output 106 of accumulated battery status comparator 20 is low. When the voltage at the output 94 of shift register 18 becomes greater than threshold voltage Vy, output 106 of accumulated battery status comparator 20 changes to a high state. This change of state indicates that at least three of the sixteen digital outputs Q2-Q17 of digital shift registers 48 and 50 are high. In other words, at least three of the previous sixteen scans of the input voltage have resulted in below-threshold measurements, setting flags in status shift register 18. Output 106 of accumulated battery status comparator 20 will be at a low state when fourteen or more of digital

outputs Q2-Q17 are low, indicating a normal input condition.

When output 106 changes to its high state, indicator switch 22 changes the state of output 108. Indicator switch 22 includes resistor 110 and metal-oxide semiconductor field-effect transistor 112. Resistor 110 provides a current limit to the gate of transistor 112. Transistor 112 is configured to provide an open drain transistor output switch for the purpose of indicating accumulated battery status. Output 108 may thus be connected to another apparatus such as light emitting diode 114 and current limiting resistor 116 to provide a visual indication of the low-voltage condition.

In accordance with this preferred embodiment, the fixed time base generator 24 preferably includes resistor 118, capacitor 120 and oscillator and frequency divider 122. Resistor 118 and capacitor 120 set the base frequency for oscillator and frequency divider 122. Fixed time base generator 24 provides a clock signal to status shift register 18. This clock signal has a frequency, derived from the base frequency by oscillator and frequency divider 122, that is preferably one cycle per two hours. This is the frequency at which the input voltage is scanned.

Circuit power supply 26 preferably includes diodes 124, 126, 128 and 130, capacitors 132 and 134, and resistor 136. Diodes 124, 126 and 128 and capacitor 132 provide transient suppression, reverse voltage protection and noise filtering of the power supply. Resistor 136, diode 130 and capacitor 134 function to provide voltage-regulated power for operational amplifier 44, first digital shift register 48, second digital shift register 50, operational amplifier 98, operational amplifier 100, and oscillator and frequency divider 122, in the form of voltage Vcc. Voltage Vcc is preferably regulated to be a substantially constant five volts above negative input 14, without regard to the actual input voltage at positive input 12. Voltage Vcc is provided as the positive power supply voltage to operational amplifier 44, first digital shift register 48, second digital shift register 50, operational amplifier 98, operational amplifier 100, and oscillator and frequency divider 122. These circuit elements have the voltage at negative input 14, generally system ground, as their negative power supply voltage. Hence, circuit power supply 26 functions to maintain the potential difference between Vcc and system ground at five volts.

Regulated voltage reference 28 preferably includes resistors 138, 140 and 142, diode 144 and capacitor 146. The output voltages of regulated voltage reference 28 are threshold voltage Vx and threshold voltage Vy. Preferably, threshold voltages Vx and Vy are both temperature and voltage compensated in order that their values will not vary substantially with variations in ambient temperature or input voltage. As previously mentioned, threshold voltages Vx and Vy are the threshold voltages for present battery status comparator 16 and accumulated battery status comparator 20, respectively.

From the foregoing, it can be seen that the present invention provides a voltage monitor and warning apparatus and method for repetitively scanning a DC voltage, comparing with a predetermined threshold voltage, and providing an indication when the DC voltage is less than the threshold voltage during three or more of sixteen successive scans.

While a particular embodiment of the present invention has been shown and described, modifications may be made, and it is therefore intended in the appended claims to cover all such changes and modifications which fall within the scope of the invention as claimed.

Claims

1. A voltage monitor for sensing the output voltage (30) of a voltage source (12) and producing an indication (114) when said output voltage (30) falls below a threshold voltage (Vx), said voltage monitor comprising:

   voltage sensing means (36,38,16) for sensing said output voltage (30) and including first comparator means (44) for comparing said output voltage (30) with said threshold voltage (Vx) and generating an output (34) when said output voltage is less than said threshold voltage;
   status storage means (18) coupled to said voltage sensing means (36,38,16) for periodically sampling and storing the status of said first comparator output (34) so as to create an accumulated status (94);
   second comparator means (20) for comparing said accumulated status (94) with a predetermined value (Vy); and
   output means (22) for providing said indication (114) when said accumulated status (94) is equal to or greater than said predetermined value (Vy).

2. A voltage monitor as defined in claim 1 wherein said status storage means (18) comprises a plurality of storage means (48,50) for storing a like plurality of said first comparator outputs (34).

3. A voltage monitor as defined in claim 2, wherein each of said plurality of storage means (48,50) has an associated order, said order being from highest to lowest, and wherein said status storage means is responsive to a clock signal (88) for discarding the contents of the highest-ordered of said storage means, sequentially moving the contents of each of said storage means (48) to the next highest-ordered storage means (50), and storing said first comparator output (34) in the lowest-ordered of said storage means (48).

4. A voltage monitor as defined in claim 3 further comprising a timing means (24) for generating said clock signal (88).

5. A voltage monitor as defined in claim 3 wherein said status storage means (18) comprises a shift register.

6. A battery voltage monitor for sensing a depletable battery voltage (30) and producing an indication (114) when said battery voltage (30) falls below a first threshold voltage (Vx), said battery voltage monitor comprising:

threshold-generating means (28,140,142) for generating said first threshold voltage (Vx) and a second threshold voltage (Vy); and
voltage sensing means (36,38,16) for sensing said battery voltage (30), including first comparator means (44) for comparing said battery voltage (30) with said first threshold voltage (Vx) and generating an output (34) when said battery voltage (30) is less than said first threshold voltage (Vx);
status storage means (18) coupled to said voltage sensing means (16) for periodically sampling and storing the status of said first comparator output (34) and generating an accumulated battery status (94),
second comparator means (20) for comparing said accumulated battery status (94) with said second threshold voltage (Vy) and generating a second comparator output (106) when said accumulated battery status (94) is greater than said second threshold voltage (Vy);
output means (22) responsive to said second comparator output (106) for providing said indication (114);
power supply means (26) for generating a regulated supply voltage level and coupled to said first comparator means (44), said second comparator means (20), said status storage means (18), and said threshold generating means (28,144,142).

7. A battery voltage monitor as defined in claim 6 wherein said status storage means (18) comprises a plurality of storage means (48,50) for storing a like plurality of said first comparator outputs (34) in response to a clock signal (88).

8. A battery voltage monitor as defined in claim 11 further comprising a timing means (24) for generating said clock signal (88).

9. A battery voltage monitor as defined in claim 12 wherein said status storage means (18) comprises a shift register (48,50).

10. A method for sensing the output voltage (30) of a voltage source (12) and producing an indication (114) when said output voltage (30) falls below a predetermined threshold voltage (Vx), said method comprising:

sensing (36,38) said output voltage (30);
comparing (16) said output voltage (30) with said threshold voltage (Vx) and generating an output (34) when said output voltage (30) is less than said threshold voltage (Vx);
periodically sampling and storing (18,24) said output (114) and generating an accumulated status (94);
comparing (20) said accumulated status (94) with a predetermined value (Vy); and
producing (22) said indication (114) when said accumulated status (94) is equal to or greater than said predetermined value (Vy).

11. A method for sensing a depletable battery voltage (30) and producing an indication (114) when said battery voltage (30) falls below a first threshold voltage (Vx), said method comprising:

sensing (36,38) said battery voltage (30);
comparing (16) said battery voltage (30) with said first threshold voltage (Vx) and generating an output (34) having a first state (HIGH) when said battery voltage (30) is less than said first threshold voltage (Vx) and a second state (LOW) when said battery voltage (30) is more than said first threshold voltage (Vx);
periodically sampling and storing (18,24) said output (34);
combining (52-82) said stored outputs (34) to generate an accumulated battery status voltage (94);
comparing (22) said accumulated battery status voltage (94) with a second threshold voltage (Vy); and
producing (22) said indication (114) when said accumulated battery status voltage (94) is greater than said second threshold voltage (Vy).

12. A method as defined in claim 11 including the further step of generating a clock signal (88) to clock said periodic sampling and storing of said output (34).

Patentansprüche

1. Spannungswächter zum Erfassen der Ausgangsspannung (30) einer Spannungsquelle (12) und zum Erzeugen einer Anzeige (114), wenn die Ausgangsspannung (30) unter eine Schwellenspannung (Vx) sinkt, wobei der Spannungswächter um-

faßt:

eine Spannungserfassungseinrichtung (36, 38, 16) zum Erfassen der Ausgangsspannung (30) und mit einer ersten Komparatoreinrichtung (44) zum Vergleichen der Ausgangsspannung (30) mit der Schwellenspannung (Vx) und zum Erzeugen eines Ausgangssignals (34), wenn die Ausgangsspannung niedriger als die Schwellenspannung ist;
eine Statusspeichereinrichtung (18), die mit der Spannungserfassungseinrichtung (36, 38, 16) verbunden ist, zum periodischen Abtasten und Speichern des Status des Ausgangssignals (34) des ersten Komparators, so daß ein akkumulierter Status (94) erzeugt wird;
eine zweite Komparatoreinrichtung (20) zum Vergleichen des akkumulierten Status (94) mit einem vorbestimmten Wert (Vy); und
eine Ausgangseinrichtung (22) zum Liefern einer Anzeige (114), wenn der akkumulierte Status (94) gleich dem vorbestimmten Wert (Vy) oder größer als dieser ist.

2. Spannungswächter nach Anspruch 1, wobei die Statusspeichereinrichtung (18) eine Anzahl von Speichereinrichtungen (48, 50) umfaßt zum Speichern einer gleichen Anzahl der Ausgangssignale (34) des ersten Komparators.

3. Spannungswächter nach Anspruch 2, wobei jede Speichereinrichtung der Anzahl von Speichereinrichtungen (48, 50) eine zugewiesene Ordnung hat, die von der höchsten bis zur niedrigsten reicht, und wobei die Statusspeichereinrichtung auf ein Taktsignal (88) anspricht, um den Inhalt der Speichereinrichtung höchster Ordnung auszurangieren, den Inhalt jeder Speichereinrichtung (48) sequentiell zu der nächsten Speichereinrichtung (50) höchster Ordnung zu bewegen und das Ausgangssignal (34) des ersten Komparators in der Speichereinrichtung (48) niedrigster Ordnung zu speichern.

4. Spannungswächter nach Anspruch 3, weiter mit einer Takteinrichtung (24) zum Erzeugen des Taktsignals (88).

5. Spannungswächter nach Anspruch 3, wobei die Statusspeichereinrichtung (18) ein Schieberegister aufweist.

6. Batteriespannungswächter zum Erfassen der Spannung (30) einer leerbaren Batterie und zum Erzeugen einer Anzeige (114), wenn die Batteriespannung (30) unter einen ersten Schwellenwert (Vx) sinkt, wobei der Batteriespannungswächter umfaßt:

eine Schwellenwerterzeugungseinrichtung (28, 140, 142) zum Erzeugen der ersten Schwellenspannung (Vx) und einer zweiten Schwellenspannung (Vx); und
eine Spannungserfassungseinrichtung (36, 38, 16) zum Erfassen der Batteriespannung (30), mit einer ersten Komparatoreinrichtung (44) zum Vergleichen der Batteriespannung (30) mit der ersten Schwellenspannung (Vx) und zum Erzeugen eines Ausgangssignals (34), wenn die Batteriespannung (30) niedriger als die erste Schwellenspannung (Vx) ist;
eine Statusspeichereinrichtung (18), die mit der Spannungserfassungseinrichtung (16) verbunden ist, zum periodischen Abtasten und Speichern des Status des Ausgangssignals (34) des ersten Komparators und zum Erzeugen eines akkumulierten Batteriestatus (94);
eine zweite Komparatoreinrichtung (20) zum Vergleichen des akkumulierten Batteriestatus (94) mit der zweiten Schwellenspannung (Vy) und zum Erzeugen eines zweiten Komparatorausgangssignals (106), wenn der akkumulierte Batteriestatus (94) größer als die zweite Schwellenspannung (Vy) ist;
eine Ausgangseinrichtung (22), die auf das zweite Komparatorausgangssignal (106) anspricht, um die Anzeige (114) zu liefern; und
eine Stromversorgungseinrichtung (26) zum Erzeugen eines geregelten Versorgungsspannungswertes, die mit der ersten Komparatoreinrichtung (44), der zweiten Komparatoreinrichtung (20), der Statusspeichereinrichtung (18) und der Schwellenwerterzeugung (28, 144, 142) verbunden ist.

7. Batteriespannungswächter nach Anspruch 6, wobei die Statusspeichereinrichtung (18) eine Anzahl von Speichereinrichtungen (48, 50) aufweist zum Speichern einer gleichen Anzahl der Ausgangssignale (34) des ersten Komparators auf ein Taktsignal (88) hin.

8. Batteriespannungswächter nach Anspruch 11, weiter mit einer Takteinrichtung (24) zum Erzeugen des Taktsignals (88).

9. Batteriespannungswächter nach Anspruch 12, wobei die Statusspeichereinrichtung (18) ein Schieberegister (48, 50) aufweist.

10. Verfahren zum Erfassen der Ausgangsspannung (30) einer Spannungsquelle (12) und zum Erzeugen einer Anzeige (114), wenn die Ausgangsspannung (30) unter einer vorbestimmten Schwellenspannung (Vx) sinkt, wobei das Verfahren umfaßt:

Erfassen (36, 38) der Ausgangsspannung (30);

Vergleichen (16) der Ausgangsspannung (30) mit der Schwellenspannung (Vx) und Erzeugen eines Ausgangssignals (34), wenn die Ausgangsspannung (30) niedriger als die Schwellenspannung (Vx) ist;
periodisches Abtasten und Speichern (18, 24) des Ausgangssignals (114) und Erzeugen eines akkumulierten Status (94);
Vergleichen (20) des akkumulierten Status (94) mit einem vorbestimmten Wert (Vy); und
Erzeugen (22) der Anzeige (114), wenn der akkumulierte Status (94) gleich dem vorbestimmten Wert (Vy) oder größer als dieser ist.

11. Verfahren zum Erfassen einer Spannung (30) einer leerbaren Batterie und Erzeugen einer Anzeige (114), wenn die Batteriespannung (30) unter einem ersten Schwellenwert (Vx) sinkt, wobei das Verfahren beinhaltet:

Erfassen (36, 38) der Batteriespannung (30);
Vergleichen (16) der Batteriespannung (30) mit der ersten Schwellenspannung (Vx) und Erzeugen eines Ausgangssignals (34), das einen ersten Zustand (HOCH) hat, wenn die Batteriespannung (30) niedriger als die erste Schwellenspannung (Vx) ist, und einen zweiten Zustand (NIEDRIG), wenn die Batteriespannung (30) größer als die erste Schwellenspannung (Vx) ist;
periodisches Abtasten und Speichern (18, 24) des Ausgangssignals (34);
Verknüpfen (52-82) der gespeicherten Ausgangssignale (34), um eine Akkumulierter-Batteriestatus-Spannung (94) zu erzeugen;
Vergleichen (22) der Akkumulierter-Batteriestatus-Spannung (94) mit einer zweiten Schwellenspannung (Vx) ; und
Erzeugen (22) der Anzeige (114), wenn die Akkumulierter-Batteriestatus-Spannung (94) größer ist als die zweite Schwellenspannung (Vy).

12. Verfahren nach Anspruch 11, beinhaltend den weiteren Schritt Erzeugen eines Taktsignals (88) zum Takten des periodischen Abtastens und Speicherns des Ausgangssignals (34).

Revendications

1. Appareil de surveillance d'une tension pour détecter la tension de sortie (30) d'une source de tension (12) et pour produire une indication (114) lorsque cette tension de sortie (30) tombe en dessous d'une tension de seuil (Vx), caractérisé en ce qu'il comprend des moyens de détection d'une tension (36,38,16) pour détecter la tension de sortie (30) et comportant un premier moyen comparateur (44) pour comparer la tension de sortie (30) avec la tension de seuil (Vx) et pour produire une sortie (34) lorsque la tension de sortie est inférieure à la tension de seuil, un moyen de stockage de statut (18) relié aux moyens de détection de la tension (36,38,16) afin d'échantillonner et de stocker périodiquement le statut de la sortie (34) du premier comparateur de manière à créer un statut cumulé (94), un second moyen comparateur (20) pour comparer le statut cumulé (94) avec une valeur prédéterminée (Vy), et un moyen de sortie (22) pour fournir l'indication (114) lorsque le statut cumulé (94) est égal ou supérieur à la valeur prédéterminée (Vy).

2. Appareil de surveillance d'une tension suivant la revendication 1 caractérisé en ce que le moyen de stockage du statut (18) comprend une pluralité de moyens de stockage (48,50) pour stocker une même pluralité de sorties (34) du premier comparateur.

3. Appareil de surveillance d'une tension suivant la revendication 2 caractérisé en ce que chacun des moyens parmi la pluralité de moyens de stockage (48,50) a un rang associé, ce rang allant du plus élevé au plus bas, et le moyen de stockage du statut répond à un signal d'horloge (88) pour rejeter le contenu de celui des moyens de stockage qui a le rang le plus élevé, pour déplacer successivement le contenu de chacun des moyens de stockage (48) vers le moyen de stockage (50) de rang immédiatement supérieur, et pour stocker la sortie (34) du premier comparateur dans celui des moyens de stockage (48) qui a le rang le plus bas.

4. Appareil de surveillance d'une tension suivant la revendication 3 caractérisé en ce qu'il comprend en outre un générateur de base de temps (24) pour produire le signal d'horloge (88).

5. Appareil de surveillance d'une tension suivant la revendication 3 caractérisé en ce que le moyen de stockage du statut (18) comprend un registre à décalage.

6. Appareil de surveillance de la tension d'une batterie pour détecter une tension (30) d'une batterie épuisable et pour produire une indication (114) lorsque la tension de la batterie (30) tombe en dessous d'une première tension de seuil (Vx), caractérisé en ce qu'il comprend des moyens générateurs de seuils (28,140,142) pour produire la première tension de seuil (Vx) et une seconde tension de seuil (Vy), et des moyens de détection de tension (36,38,16) pour détecter la tension de la batterie (30), comprenant un premier comparateur (44) pour comparer la tension (30) de la batterie avec la première tension de seuil (Vx) et pour produire une sortie (34) lorsque la tension (30) de la batterie est in-

férieure à la première tension de seuil (Vx), un moyen de stockage de statut (18) relié aux moyens de détection de tension (16) afin d'échantillonner et de stocker périodiquement le statut de la sortie (34) du premier comparateur et de produire un statut cumulé (94) de la batterie, un second comparateur (20) pour comparer le statut cumulé (94) de la batterie avec la seconde tension de seuil (Vy) et pour produire une sortie (106) du second comparateur lorsque le statut cumulé (94) de la batterie est supérieur à la seconde tension de seuil (Vy), un moyen de sortie (22) répondant à la sortie (106) du second comparateur en fournissant l'indication (114) et un moyen d'alimentation électrique (26) pour produire un niveau de tension d'alimentation régulé et relié au premier comparateur (44), au second comparateur (20), au moyen de stockage du statut (18) et aux moyens générateurs de seuils (28,144,142).

7. Appareil de surveillance d'une batterie suivant la revendication 6 caractérisé en ce que le moyen de stockage du statut (18) comprend une pluralité de moyens de stockage (48,50) pour stocker une même pluralité de sorties (34) du premier comparateur en réponse à un signal d'horloge (88).

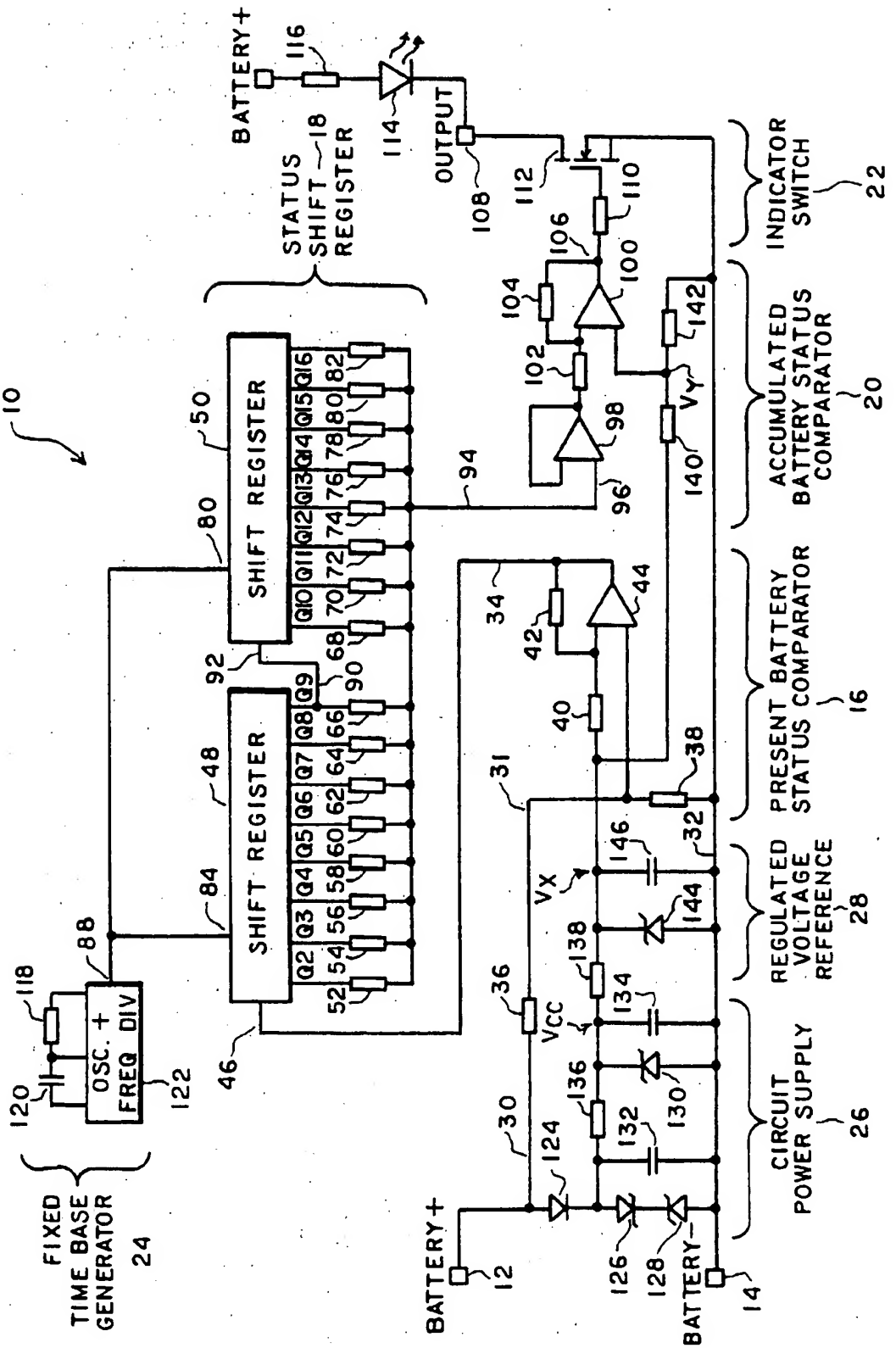
8. Appareil de surveillance d'une batterie suivant la revendication 11 caractérisé en ce qu'il comprend en outre un générateur de base de temps (24) pour produire le signal d'horloge (88).

9. Appareil de surveillance d'une batterie suivant la revendication 12 caractérisé en ce que le moyen de stockage du statut (18) comprend un registre à décalage (48,50).

10. Procédé pour détecter la tension de sortie (30) d'une source de tension (12) et pour produire une indication (114) lorsque cette tension de sortie (30) tombe en dessous d'une tension de seuil prédéterminée (Vx), caractérisé en ce qu'il comprend les étapes consistant à détecter (36,38) la tension de sortie (30), à comparer (16) cette tension de sortie (30) avec la tension de seuil (Vx) et à produire une sortie (34) lorsque la tension de sortie (30) est inférieure à la tension de seuil (Vx), à échantillonner et stocker périodiquement (18,24) la sortie (114) et à produire un statut cumulé (94), à comparer (20) le statut cumulé (94) avec une valeur prédéterminée (Vy) et à produire (22) l'indication (114) lorsque le statut cumulé (94) est égal ou supérieur à la valeur prédéterminée (Vy).

11. Procédé pour détecter la tension (30) d'une batterie épuisable et pour produire une indication (114) lorsque la tension (30) de la batterie tombe en dessous d'une première tension de seuil (Vx), caractérisé en ce qu'il comprend les étapes consistant à détecter (36,38) la tension (30) de la batterie, à comparer (16) cette tension (30) de la batterie avec la première tension de seuil (Vx) et à produire une sortie (34) ayant un premier niveau (haut) lorsque la tension (30) de la batterie est inférieure à la première tension de seuil (Vx) et un second niveau (bas) lorsque la tension (30) de la batterie est supérieure à la première tension de seuil (Vx), à échantillonner et stocker périodiquement (18,24) la sortie (34), à combiner (52-82) les sorties stockées (34) de manière à produire une tension (94) de statut cumulé de la batterie, à comparer (22) cette tension (94) de statut cumulé de la batterie avec une seconde tension de seuil (Vy), et à produire (22) l'indication (114) lorsque la tension (94) de statut cumulé de la batterie est supérieure à la seconde tension de seuil (Vy).

12. Procédé suivant la revendication 11 caractérisé en ce qu'il comprend l'étape additionnelle consistant à produire un signal d'horloge (88) pour commander dans le temps l'échantillonnage et le stockage périodiques de la sortie (34).


10
BATTERY+
116
114
OUTPUT
108
112
110
106
100
104
102
98
96
94
STATUS SHIFT REGISTER
18
INDICATOR SWITCH
22
ACCUMULATED BATTERY STATUS COMPARATOR
20
PRESENT BATTERY STATUS COMPARATOR
16
REGULATED VOLTAGE REFERENCE
28
CIRCUIT POWER SUPPLY
26
SHIFT REGISTER
50
SHIFT REGISTER
48
Q10 Q11 Q12 Q13 Q14 Q15 Q16
Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9
80
82
78
76
74
72
70
68
92
90
66
64
62
60
58
56
54
52
84
46
88
OSC. + FREQ DIV
122
120
118
FIXED TIME BASE GENERATOR
24
BATTERY+
12
BATTERY-
14
30
124
126
128
132
130
136
134
138
36
Vcc
Vx
146
144
32
31
38
40
42
44
34
140
Vy
142